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Dirk Nuber

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EXAMINER

SHEVIN, MARK L

ART UNIT

PAPER NUMBER

1793

NOTIFICATION DATE

DELIVERY MODE

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ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 10/540,376	Applicant(s) NUBER ET AL.	
	Examiner Mark L. Shevin	Art Unit 1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 September 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-31 and 33-38 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-31 and 33 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>09/02/2008</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Status of Claims

1. Claims 1-31 and 33-38, filed September 2nd, 2008, are currently under examination. Claims 1 and 28 were amended while claim 32 was cancelled.

Terminal Disclaimer

2. The terminal disclaimer filed on September 2nd, 2008, disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of any U.S. patent issuing from Serial No. 10/540,438 has been reviewed and is accepted. The terminal disclaimer has been recorded.

Information Disclosure Statement

3. The information disclosure statement (IDS) submitted September 2nd, 2008 is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement has been considered by the examiner. Please refer to applicants' copy of the 1449 form submitted herewith.

Status of Previous Rejections

4. The previous rejection of claim 1 under 35 U.S.C. 112 second paragraph in the Office action dated June 2nd, 2008 has been withdrawn in view of Applicants' amendment of claim 1.

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

5. The previous rejections of claims 1-5 under nonstatutory obviousness-type double patenting over claims 1-5 of pre-grant publication US 2006/0249100 (US

Art Unit: 1793

10/540,438) have been withdrawn in view of Applicants' terminal disclaimer filed September 2nd, 2008.

6. The previous rejections of claims 1-5 under nonstatutory obviousness-type double patenting over claims 1-6 of pre-grant publication US 2006/0230879 (US 10/540,352) have been withdrawn in view of the abandonment of application 10/540,352 on November 24th, 2008.

Claim Rejections - 35 USC § 103

7. **Claims 1-30, 33-34, and 36-38** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Formanek** (AU 9894057 A) in view of **Hiltunen** (US 5,505,907) and any one of **Beisswenger** (US 4,817,563), **Reh** (US 4,080,437), or **Schmidt** (US 4,402,754)

Formanek

Formanek teaches a method for the heat treatment of solids containing titanium in which reduction of ilmenite is performed in a manner suitable for commercial plants and to operate as inexpensively as possible (p. 1, para 3). Ilmenite is reduced in stationary fluidized bed using a reducing fluidizing gas in a temperature range of 600 - 1000 °C and an H₂ + CO content of 80 – 100 vol% (p. 2, para 1).

Formanek does not teach a fluidized bed furnace with a central gas supply tube that is at least partly surrounded by a stationary annular fluidized bed where the gas flowing through the tube entrains solids from the fluidized bed nor the particle Froude numbers.

Hiltunen

Art Unit: 1793

Hiltunen, drawn to an apparatus for utilizing a hot gas flow (Title), teaches a reactor **10** with an annular chamber **12** provided with a fluidized bed **14**. A central gas inlet duct / conduit (gas supply tube) **16** surrounded by the stationary fluidized bed and the top edge (upper orifice) is even with the top surface of the fluidized bed **20** (col. 4, lines 1-6). The reactor functions by pushing particles as overflow over the inlet duct edges **18** where the hot gas flowing through the inlet cools and correspondingly heats the solid particles (col. 4, lines 45-55).

Appropriate fluidizing is maintained by flowing fluidizing gas through nozzles **52** in to the annular chamber **12** and the volume of the solid particles in the reactor may be regulated by adding particles via conduit **54** or by discharging them via conduct **56**.

The upper surface of the bed **14**, may be arranged a higher level than the top level of the duct **16** and its edges **18** so that solid particles overflow **50** and are entrained in the hot gas supply (col. 6, lines 15-50), the advantage being less fouling and clogging of the inlet duct.

Beisswenger – Reh - Schmidt

These three references are all drawn to methods of operating fluidized beds, and teach that it is well known in the art to define the operating conditions of a fluidized bed by using Froude numbers (Beisswenger, col. 3, lines 20-45, Reh, col. 3, lines 5-30, Schmidt, col. 2 line 58 – col. 3, line 18.).

Regarding claim 1, it would have been obvious to one of ordinary skill in fluidized bed furnace design, at the time the invention was made, taking the disclosures of Formanek, Hiltunen and one of Beisswenger, Reh, or Schmidt as a whole, to

Art Unit: 1793

incorporate the reactor design of Hiltunen and the particle Froude number control means of Beisswenger, Reh, or Schmidt into the titanium ore (ilmenite) reduction process of Formanek for at least the following reasons. One would be motivated to use the apparatus of Hiltunen as he taught that his particle overflow and gas entrainment method reduced fouling and improved heat exchange while one would be motivated to use the particle Froude numbers of Beisswenger, Reh, and Schmidt as the three all taught the particle Froude numbers as well-known means of controlling fluidized beds and one would reasonably expect such control to ensure effective and gentle transport of solids in a reactor.

With respect to the amendment to claim 1 removing “preferably central”, Hiltunen taught a reactor **10** with an annular chamber **12** provided with a fluidized bed **14**. A central gas inlet duct / conduit (gas supply tube) **16** surrounded by the stationary fluidized bed and the top edge (upper orifice) is even with the top surface of the fluidized bed **20** (col. 4, lines 1-6). The reactor functions by pushing particles as overflow over the inlet duct edges **18** where the hot gas flowing through the inlet cools and correspondingly heats the solid particles (col. 4, lines 45-55). Thus the cited art still applies to amended claim 1.

Regarding claims 2-4, Beisswenger, Reh, and Schmidt all teach the important of using particle Froude numbers and the instantly claimed ranges are not regarded as patentable distinctions in view of the tendency of one of ordinary skill to optimize reaction conditions in the course of routine experimentation as MPEP 2144.05 II(A)

Art Unit: 1793

states: "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."

Regarding claim 5, Hiltunen teaches that the upper surface of the fluidized bed **14**, may be arranged a higher level than the top level of the duct **16** and its edges **18** so that solid particles overflow **50** and are entrained in the hot gas supply (col. 6, lines 15-50),

Regarding claim 6, apertures on the shell surface do not represent a patentable distinction in that one of ordinary skill in the art would recognize from Hiltunen that apertures work to increase the effective area by which solid particles may overflow into the incoming hot gas stream of the inlet duct / conduit.

Regarding claim 7, Formanek teaches the reduction of ilmenite.

Regarding claim 8-11, Formanek teaches that a fluidizing gas containing at least 90 vol% hydrogen at a temperature of 600-1000 °C (p. 7, para 2) and it would have been obvious to one of ordinary skill in the art at the time of the invention to choose the instantly claimed ranges through process optimization, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. See In re Boesch, 205 USPQ 215 (CCPA 1980). Furthermore, MPEP 2144.05, para I states: "In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a *prima facie* case of obviousness exists." With respect to the water vapor and nitrogen contents, the hydrogen-containing gas of Formanek appears to be substantially similar to the claimed composition and accomplishes the same goal in reducing ilmenite and thus one of

Art Unit: 1793

ordinary skill would reasonably expect it to have nominal water vapor and / or nitrogen contents.

Regarding claims 12-17, Formanek teaches that at least part of the exhaust gas from the second reactor, which is provided downstream of the first reactor, is introduced into the first reactor (p. 2, para 1) and from Hiltunen, one would be motivated to recycled such gas to recovery the waste heat to further heat additional ilmenite ore. Formanek further teaches the iron metallization is approximately 85-98%, which is within the claimed ranges (p. 2, para 1). Cooling stages are provided downstage of the second reactor (p. 6, para 1) and cyclones are provided to separate solids from the exhaust gas and recirculated these solids to the reactor(s) (p. 11, para 2).

Regarding claim 18, the ilmenite is magnetically roasted (at least partially oxidized) (p. 7 para 2).

Regarding claims 19 and 20, fuel in the form of natural gas is supplied to the fluidized combustion chamber (p. 7, para 1). With respect to introducing the gaseous fuel to both the fluidized bed and the gas supply tube, one of ordinary skill in reducing ilmenite, would seek to introduce fuel evenly to the ilmenite so that reduction and favorable chemical reaction would occur quickly.

Regarding claim 21, Formanek teaches gas may be re-heated (pre-heated) by two fired heaters **23a** and **23b** before it is reused in the first or second reactors (p. 8, para 2).

Art Unit: 1793

Regarding claims 22 and 25, Formanek suggests that ilmenite from the annular stationary fluidized bed is subjected to a cooling medium in downstage cooling chambers **2c** and **2d** and it separated by cyclone (p. 6, para 1 and 2).

Regarding claims 23 and 24, Formanek teaches that at least part of the exhaust gas is separated from solids in a downstream separator, supplied to a pre-heating stage equipped with a dryer and a separator (p. 4, para 1).

Regarding claims 26 and 27, one of ordinary skill would be motivated to spray water to cool the solids below 300 °C as Formanek teaches that the cooled ilmenite is withdrawn for further treatment and processing to obtain synthetic rutile and one would appreciate that this process will occur at lower temperatures and as one could choose from commonly use cooling media such as air and water to cool the ilmenite.

Regarding claims 28 and 33, the method of claim 1 that was rejected above included all these claimed features. Formanek suggests that ilmenite from the annular stationary fluidized bed is subjected to a cooling medium in downstage cooling chambers **2c** and **2d** and it separated by cyclone (p. 6, para 1 and 2). Furthermore, the exhaust gas is re-processing downstream of the solids separator (p. 4, para 1). (See also the rejections for claims 19-27).

With respect to the amendment to claim 28 adding "the plant further comprising a solids separator downstream the reactor, wherein the solids separator comprises a solids conduit leading to the annular fluidized bed of the reactor", Formanek taught (Abstract) that a separator at least partly separates solids from the gas stream coming

Art Unit: 1793

from the upper portion of a first fluidized bed reactor and separated solids are at least partly recirculated to the first fluidized-bed reactor.

In particular, the circulation of solids using the separator and back to the reactor is said (p. 2, para 2) to provide high reaction rates and long dwell times of solids in the reactor.

Hiltunen, which provides the design for the fluidized bed, taught the solids particles are separated from the cooled gas and returned to the fluidized bed (col. 1, lines 17-20). Although Hiltunen taught at col. 4, lines 45-53 that the gas and solid particles flow up through riser **22**, through openings **26** and are separated at **28**, Hiltunen's design appears to recirculate substantially all of the solids but does not preclude or teach away from the provision of a downstream separator as if by Formanek's method, at least part of the solids are returned to the fluidized bed, additional solids are added to the annular fluidized bed through solids conduit **54** as provided by Hiltunen (col. 5, lines 1-4). It would have been obvious to one of ordinary skill in the fluidized bed design, at the time of the invention, to modify the fluidized bed reactor of Hiltunen to have a downstream separator instead of a separation system off the risers as Formanek taught that such a downstream separation scheme to provides high reaction rates and long dwell times of solids in the reactor. To return solids to the annular fluidized bed, one would be motivated to use the existing solids conduit **54** of Hiltunen as it was designed to receive solids for introduction to the bed and is stated to be used to regulate the volume of solid particles in the reactor (col. 5, lines 1-4).

Regarding claim 29 and 30, Hiltunen discloses these features in Figures 1-3.

Regarding claim 34, Formanek teaches that at least part of the exhaust gas from the second reactor, which is provided downstream of the first reactor, is introduced into the first reactor (p. 2, para 1) and from Hiltunen, one would be motivated to recycled such gas to recovery the waste heat to further heat additional ilmenite ore.

Regarding claim 36, Formanek teaches a pre-heating stage for the solids (p. 4, para 1 and para 2).

Regarding claims 37 and 38, Formanek teaches cooling stages are provided downstage of the second reactor (p. 6, para 1) and cyclones are provided to separate solids from the exhaust gas and recirculated these solids to the reactor(s) (p. 11, para 2).

8. **Claim 31** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Formanek** in view of **Hiltunen** and any one of **Beisswenger**, **Reh**, or **Schmidt** as applied to claims 1, 2-30, 32-34, and 36-38 above, in further view of **Lapple** (US 3,578,798).

The disclosures of Formanek, Hiltunen, Beisswenger, Reh, and Schmidt, were discussed above, however none of these references specifically teaches a gas distributor which divides the chamber into an upper fluidized bed and lower combustion region.

Lapple

Art Unit: 1793

Lapple, drawn to a fluidized bed unit formed of single or multiple stages and combustion used to provide heat for reaction, teaches in Figure 1, a lower plenum **20** for admitting combustion air defined by plate **21** with perforated annular member **31** spaced above plate **22** to form the roof for chamber **30** (col. 2, lines 5-35). The lowermost chamber provides a plenum for admitting combustion air. A fluidized bed **33** is maintained in the space between **31** and the top **16** (col. 2, lines 35-45).

Regarding claim 31, it would have been obvious to one of ordinary skill in fluidized bed furnace design, at the time the invention was made, taking the disclosures of Formanek, Hiltunen, Lapple, and one of Beisswenger, Reh, or Schmidt as a whole, to incorporate the gas distributor plate design of Lapple that holds a fluidized bed above a combustion plenum, as Lapple teaches that his design drastically increases the solids-handling capacity of a fluidized bed (col. 1, lines 15-20).

9. Claim 35 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Formanek** in view of **Hiltunen** and any one of **Beisswenger**, **Reh**, or **Schmidt** as applied to claims 1, 2-30, 32-34, and 36-38 above, in further view of **Engstrom** (WO 90/11824)

The disclosures of Formanek, Hiltunen, Beisswenger, Reh, and Schmidt, were discussed above, however none of these references specifically teaches a supply conduit for fuel leading to a lance arrangement which opens out into the annular fluidized bed.

Engstrom

Art Unit: 1793

Engstrom, Drawn to a fluidized bed reactor with a protected fluid distributor, teaches that in large reactors it is especially difficult to achieve even distribution of fluid and/or particulate material throughout the whole cross sectional area of the reaction chamber and that this uneven distribution may cause significant problems (p. 2, lines 1-10).

The object of Engstrom's invention is to provide even distribution of fluid (which may be gaseous) in large reactors over the whole of the cross sectional area through reliable and easy-to-clean fluid inlet means (p. 5, lines 15-30.) Fluidized gas may be introduced through a standard gas distributor plate (p. 5 line 33 - p. 6, line 5) while fluid inlets are in the form of lances arranged to penetrate the side walls of the reactor and pass into the combustion chamber 2 and the fluid fuel used may be a gas (p. 10, lines 22-33). Figure 2 in particular shows a lance arrangement for injecting fuel.

Regarding claim 35, it would have been obvious to one of ordinary skill in fluidized bed furnace design, at the time the invention was made, taking the disclosures of Formanek, Hiltunen, Engstrom, and one of Beisswenger, Reh, or Schmidt as a whole, to incorporate the fuel lance arrangement of Engstrom into the fluidized bed reactor of Formanek et al, as Engstrom taught that such a lance arrangement allows uniform distribution of fuel and can thus avoid particle agglomeration and local overheating.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory

Art Unit: 1793

obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

10. Claims 1-5 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-5 of pre-grant publication US 2006/0230880 (US 10/540,434). Although the conflicting claims are not identical, they are not patentably distinct from each other for the following reasons:

Regarding claims 1 and 5, US '880 discloses in claim 1, a method for the heat treatment of solids, in a temperature range that overlaps the claimed range, with identical particle Froude numbers. Claim 1 does not disclose that the "gas flowing through the gas supply tube entrains solids from the fluidized bed into the mixing chamber when passing through the upper orifice region of the gas supply tube", however claim 5 suggests this mechanism as the solids would be expected to overflow into the central gas supply tube. Thus it would have been obvious to one of ordinary skill in fluidized bed reactors to heat treat titanium-bearing ores with the method

Art Unit: 1793

disclosed by claims 1 and 5 of US '880 as this would only represent a simple substitution of "solids containing iron oxide" for solids bearing titanium, and one of ordinary skill would be motivated to substitute as the solids substitution would not be expected to change the nature of the fluidized bed process in that many types of solids (ore in particular) are linked by the need for heat treatment in the form of roasting or calcining.

Regarding claims 2-4, US '880 discloses identical particle Froude number ranges in claims 2-4.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

11. Claims 1-5 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-5 of pre-grant publication US 2007/0137435 (US 10/540,435). Although the conflicting claims are not identical, they are not patentably distinct from each other for the following reasons:

Regarding claims 1 and 5, US '435 discloses in claim 1, a method for the heat treatment of solids, in a temperature range that overlaps the claimed range, with identical particle Froude numbers. Claim 1 does not disclose that the "gas flowing through the gas supply tube entrains solids from the fluidized bed into the mixing chamber when passing through the upper orifice region of the gas supply tube", however claim 5 suggests this mechanism as the solids would be expected to overflow into the central gas supply tube. Thus it would have been obvious to one of ordinary skill in fluidized bed reactors to heat treat titanium-bearing ores with the method

Art Unit: 1793

disclosed by claims 1 and 5 of US '435 as this would only represent a simple substitution of "solids containing iron oxide" for solids bearing titanium, and one of ordinary skill would be motivated to substitute as the solids substitution would not be expected to change the nature of the fluidized bed process in that many types of solids (ore in particular) are linked by the need for heat treatment in the form of roasting or calcining.

Regarding claims 2-4, US '435 discloses identical particle Froude number ranges in claims 2-4.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

12. Claims 1-5 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-5 of pre-grant publication US 2006/0231466 (US 10/540,436). Although the conflicting claims are not identical, they are not patentably distinct from each other for the following reasons:

Regarding claims 1 and 5, US '466 discloses in claim 1, a method for the heat treatment of solids, in a temperature range that overlaps the claimed range, with identical particle Froude numbers. Claim 1 does not disclose that the "gas flowing through the gas supply tube entrains solids from the fluidized bed into the mixing chamber when passing through the upper orifice region of the gas supply tube", however claim 5 suggests this mechanism as the solids would be expected to overflow into the central gas supply tube. Thus it would have been obvious to one of ordinary skill in fluidized bed reactors to heat treat titanium-bearing ores with the method

Art Unit: 1793

disclosed by claims 1 and 5 of US '466 as this would only represent a simple substitution of "fine-grained solid" for solids bearing titanium, and one of ordinary skill would be motivated to substitute as the solids substitution would not be expected to change the nature of the fluidized bed process in that many types of solids (ore in particular) are linked by the need for heat treatment in the form of roasting or calcining.

Regarding claims 2-4, US '466 discloses identical particle Froude number ranges in claims 2-4.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Response to Applicant's Arguments:

13. Applicant's arguments filed September 2nd, 2008 have been fully considered but they are not persuasive.

Applicants assert (p. 9, para 2 - p. 11, para 1) that the invention as recited in claim 1 is obvious over the cited references in particular because Hiltunen is completely silent as to controlling particle Froude numbers, the development of such as intensively mixed suspension in the reactor of Hiltunen is not possible, and that there is no teaching, suggestion, or motivation to control the fluidized bed.

In response, one would be motivated to use the particle Froude numbers of Beisswenger, Reh, and Schmidt as the three all taught the particle Froude numbers as well-known means of controlling fluidized beds and one would reasonably expect such control to ensure effective and gentle transport of solids in a reactor.

Applicants assert (p. 11, para 2) that the teachings with respect to particle Froude numbers cited above pertain only to the reaction conditions in circulating fluidized beds and not to stationary fluidized beds or the enablement of the transport of solid particles.

Even though the fluidized beds may not be properly classified as stationary fluidized beds, this does not detract from their teachings in the use of particle Froude numbers to define the operating conditions of the reaction to ensure proper fluidization and heat transfer. Motivation to control the fluidization of the bed through the particle Froude numbers comes from the disclosures of Beisswenger, Reh, and Schmidt in teaching the degree of fluidization using particle Froude number and defining it as an operating condition. One of ordinary skill would be motivated to optimize such operating conditions as the cited references teach such operating conditions as result effective variables in the treatment of solids by heat transfer.

Lastly, Applicants' contention regarding the impossibility of Hiltunen's reactor achieving the degree of fluidization is not supported by any evidence or a signed affidavit.

Applicants further assert (p. 11, para 1) that Hiltunen implicitly teaches away from controlling the fluidized bed by particle Froude numbers because of a lack of necessity to control or optimize heat and mass transfer to accomplish its objective.

In response, Hiltunen actually does require the control of fluidization, for example at col. 6, lines 18-30 where by adjusting the fluidization the solids may overflow the central gas supply duct. From Beisswenger, Reh, and Schmidt, one of ordinary skill, in

Art Unit: 1793

implementing a fluidized bed reactor design would be motivated to control the fluidized bed by means of particle Froude number as the Froude number is a dimensionless number (analogous to the use of Reynolds number in fluid dynamics) which factors in the relative gas velocity, and the diameter of the solid medium, comparing the inertial force with gravitational force.

Applicants assert (p. 12, para 3) that claim 28 is not obvious over the cited prior art as any modification of the fluidized bed reactor of Hiltunen to feature a downstream separator would be contrary to the teachings of Hiltunen as cited at col. 4, lines 45-53 and illogical.

In response, Formanek suggests that ilmenite from the annular stationary fluidized bed is subjected to a cooling medium in downstage cooling chambers **2c** and **2d** and it separated by cyclone (p. 6, para 1 and 2). Furthermore, the exhaust gas is re-processing downstream of the solids separator (p. 4, para 1). (See also the rejections for claims 19-27).

With respect to the amendment to claim 28 adding "the plant further comprising a solids separator downstream the reactor, wherein the solids separator comprises a solids conduit leading to the annular fluidized bed of the reactor", Formanek taught (Abstract) that a separator at least partly separates solids from the gas stream coming from the upper portion of a first fluidized bed reactor and separated solids are at least partly recirculated to the first fluidized-bed reactor.

Art Unit: 1793

In particular, the circulation of solids using the separator and back to the reactor is said (p. 2, para 2) to provide high reaction rates and long dwell times of solids in the reactor.

Hiltunen, which provides the design for the fluidized bed, taught the solids particles are separated from the cooled gas and returned to the fluidized bed (col. 1, lines 17-20). Although Hiltunen taught at col. 4, lines 45-53 that the gas and solid particles flow up through riser **22**, through openings **26** and are separated at **28**, Hiltunen's design appears to recirculate substantially all of the solids but does not preclude or teach away from the provision of a downstream separator as if by Formanek's method, at least part of the solids are returned to the fluidized bed, additional solids are added to the annular fluidized bed through solids conduit **54** as provided by Hiltunen (col. 5, lines 1-4). It would have been obvious to one of ordinary skill in the fluidized bed design, at the time of the invention, to modify the fluidized bed reactor of Hiltunen to have a downstream separator instead of a separation system off the risers as Formanek taught that such a downstream separation scheme to provides high reaction rates and long dwell times of solids in the reactor. To return solids to the annular fluidized bed, one would be motivated to use the existing solids conduit **54** of Hiltunen as it was designed to receive solids for introduction to the bed and is stated to be used to regulate the volume of solid particles in the reactor (col. 5, lines 1-4).

Applicants assert (p. 13, para 1) that the instantly claimed invention was adequately distinguished over Lapple (US 3,578,798) in the Amendment and Response to Restriction Requirement filed May 5th, 2008.

Art Unit: 1793

In response, withdrawal of the original restriction requirement does not imply that Lapple is unsuitable for what it teaches. While the entrainment mechanism of instant claim 1 was amended around that of Lapple, Lapple still provides relevant teaching with respect to fluidized bed design and the processing of solids by such beds.

Conclusion

14. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

-- Claims 1-31 and 33-38 are finally rejected

-- No claims are allowed

The rejections above rely on the references for all the teachings expressed in the texts of the references and/or one of ordinary skill in the metallurgical art would have reasonably understood or implied from the texts of the references. To emphasize certain aspects of the prior art, only specific portions of the texts have been pointed out. Each reference as a whole should be reviewed in responding to the rejection, since other sections of the same reference and/or various combinations of the cited references may be relied on in future rejections in view of amendments.

All recited limitations in the instant claims have been met by the rejections as set forth above. Applicant is reminded that when amendment and/or revision is required, applicant should therefore specifically point out the support for any amendments made to the disclosure. See 37 C.F.R. § 1.121; 37 C.F.R. Part §41.37 (c)(1)(v); MPEP §714.02; and MPEP §2411.01(B).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mark L. Shevin whose telephone number is (571) 270-3588 and fax number is (571) 270-4588. The examiner can normally be reached on Monday - Friday, 8:30 AM - 5:00 PM EST.

Art Unit: 1793

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy M. King can be reached on (571) 272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

/Mark L. Shevin/

Examiner, Art Unit 1793

/Roy King/

Supervisory Patent Examiner, Art Unit 1793

December 1st, 2008

10-540,376